DOCUMENT RESUME

ED 443 398 IR 020 276

AUTHOR Recker, Mimi M.; Olson, Daren; Rogers, Jim; duPlessis, Jacques

TITLE A Thinking Practices Framework for Instructional Technology.

PUB DATE 2000-05-24

NOTE 27p.; Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 24-28, 2000).

PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.

DESCRIPTORS Computer Assisted Instruction; Computer Uses in Education; Educational Change; *Educational Development; *Educational Practices; Educational Principles; *Educational Technology; *Educational Theories; Teaching Models

IDENTIFIERS Technology Integration

ABSTRACT

This paper examines some of the theoretical changes that have led the field of instructional and educational technology into a time of critical transactions. It begins by outlining some of the standard notions and assumptions within the field of instructional technology, and goes on to examine how they may be changing as a result of influences of socio-cultural theories of learning and instruction. These theories are used to develop a framework for analyzing thinking practices within the different communities of practice that are connected with the field of instructional technology. This "Thinking Practices" framework combines (1) Lave and Wenger's concepts of activities, identities, trajectories, and artifacts/tools within communities of practice, (2) Collin's distinction between "conserving" and "learning" communities of practice, and (3) Perkins's "five facets of learning environments." The application of this framework is illustrated with a small, exploratory case study involving students in a graduate-level instructional technology program. Implications of this framework for practices and methodologies in the field are discussed. (Contains 26 references.) (AEF)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 443 398

A Thinking Practices Framework for Instructional Technology

Mimi M. Recker, Daren Olson, Jim Rogers, Jacques duPlessis

mimi.recker @ usu.edu

Department of Instructional Technology

2830 Old Main Hill

Utah State University

Logan, UT 84332-2830

Last updated: 24 May, 2000

M. Recker

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

- ☐ This document has been reproduced as received from the person or organization originating it.
- ☐ Minor changes have been made to improve reproduction quality.
- • Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

IR020276

BEST COPY AVAILABLE

Abstract

This paper presents a theoretical framework for analyzing practices and methodologies found within the field of instructional technology. This framework is based on recent socio-cultural approaches to learning and instruction, which are generically labeled under the term "Thinking Practices." In particular, this Thinking Practices framework combines 1) Lave and Wenger's concepts of activities, identities, trajectories, and artifacts/tools within communities of practice, 2) Collin's distinction between "conserving" and "learning" communities of practice, and 3) Perkins' categories of "five facets of learning environments." The application and usefulness of this framework is illustrated via a small, exploratory case study.

Introduction

Dramatic advances in computing have led to the widespread penetration of information technology--especially Internet technologies--throughout modern society. This penetration is particularly evident in some of the world's largest information sectors, education and training. Indeed, recent surveys indicate that the fields of instructional and educational technologies are growing rapidly. In the corporate sector, many companies are increasing the size of their training departments, while others are implementing training functions for the first time (e.g., Kiser, 1999). The education sector is also experiencing extensive growth; the Lehman Brothers investment firm predicts that the education market in technology will reach several hundred billion U.S. dollars in the next few years (Zinberg, 1998). As the demand for information technology, training, and education has increased, many have argued that the standard methods and theories behind instructional strategies and technological tools can no longer provide satisfactory solutions to the problems faced by training departments and educational organizations (Gordon and Zemke, 2000).

In addition, the field of instructional technology is in the midst of a theoretical reconstruction of approaches to learning, knowing, and instruction. In particular, recent socio-cultural approaches, which we generically group under the label "Thinking Practices," have as yet unknown implications on the standard practices and methodologies of instructional technology and design.

In this paper, we will examine some of the theoretical changes that, we believe, have led the field of instructional and educational technologies into a time of critical transitions. We begin by outlining some of the standard notions and assumptions within the field of instructional technology. We will then examine how these may be changing as a result of influences of socio-cultural theories of learning and instruction. Using these theories, we develop a framework for analyzing thinking practices within the different communities of practice that are connected with the field of instructional technology. We illustrate the application of this framework via a small, exploratory case study involving students in a graduate-level instructional technology program. Finally, we conclude by discussing some of the implications that this framework suggests for the practices and methodologies found within the field of instructional technology.

Critical Transitions in Instructional Technology

The 1994 Association for Educational Communications and Technology (AECT) definition perhaps best captures the standard notion: "Instructional technology is the theory and practice of

design, development, utilization, management and evaluation of processes and resources for learning" (Seels & Richey, 1994, p. 1). Within the field of instructional technology, one of the most common design methodologies which reflects this definition is the ADDIE model (Analyze, Design, Develop, Implement, Evaluate). This standard instructional systems design model has been widely used by practitioners--with some minor variations--for several decades. The ADDIE model evolved from the theories, practices, and technologies in the fields of engineering design, training, psychology, and education. Within these fields, learning and instructional design theories were influenced first by behaviorist theories and later by cognitivist theories. These theories were based on certain assumptions concerning the nature of intelligence, cognition, knowledge, learning, and instruction. Until recently, these assumptions have rarely been questioned (Resnick, 1988). They include, but are not limited to, the following ideas:

- Learning occurs within individuals.
- Knowledge can be captured and transmitted with technological tools and artifacts.
- Cognition consists of information processing.
- Intelligence is a static, individual trait.

These assumptions drive many of the activities of instructional technologists that use the ADDIE model. For example, an instructional designer will typically analyze individual learners to determine gaps in knowledge. The designer then gathers the needed knowledge from a subject-matter expert, encodes it in a series of messages, and presents it to the individual learners. The learners have limited control over the general learning goals, specific objectives, and instructional activities. Instead, learners are expected to go through these activities in a fairly rigid manner -- a reflection of the Industrial Age paradigm of instruction in which the ADDIE model is grounded. They learn only that which is necessary to do their predefined, individual tasks within the organization; there is little need for the learner to help create new knowledge that can be shared with others. Consequently, these learning activities are often completed in isolation, without the help or even presence of others. Knowledge is assumed to be acquired on an individual basis, and assessment typically consists of standardized tests matched against content provided by the subject matter expert.

While this instructional model may have satisfied the needs of an Industrial Age society, these hierarchical and individualistic paradigms are increasingly challenged today (e.g. Derry & Lesgold, 1996; Reigeluth, 1996; Orey & Nelson, 1997). In order to adapt to the complex

challenges and fast-paced changes of the Information Age, organizations have begun to employ a variety of information technologies that are designed to capture information and facilitate the creation of new knowledge by people at all levels, not just subject-matter experts. In addition, the last decade has seen a change from traditional hierarchical corporate organizations to what Senge (1990) has termed the 'Learning Organization'. In the learning organization "employees become integral to the decision-making process, making them part of the "brain" of the organization. They work in teams to solve problems,.... [and] participate in instructing colleagues and counseling peers" (Greenwood, et al., 1993, p. 7). This new focus on distributed problem solving and responsibility for one's own learning is necessary for organizations to respond to rapid changes and remain competitive in contemporary society.

Within learning organizations, education and training are conceived differently. It is assumed that no one person "knows it all" -- especially the subject matter experts and instructors—thus there is a sense of common accountability among learners that leads towards more democratic and less hierarchical social organization of learning environments. Instead of controlling information, instructors can now focus more on increasing communication and collaboration so that new knowledge can be discovered and shared. In addition, the focus of instruction is no longer solely to memorize facts (which will quickly become outdated) or to master skill sets (which will rapidly become obsolete with the introduction of new technologies). Instead, emphasis is placed on a) learning how to think and act like knowledgeable participants in a variety of domains and b) using these thinking skills to create new knowledge. While these changes have not occurred in every business, school, or training organization, they are becoming increasingly mainstream.

In sum, the developments of new technologies and learning theories have created a critical transition period that is opening up the field to theoretical views of instructional design that move beyond the ADDIE model. This transition period provides an opportunity to examine the assumptions and rethink how instructional technologists should adapt to changes in theory, practice, and technology.

Thinking Practices

The new working and learning conditions of the Information Age require the development of new ideas about what constitutes effective instruction and the practice of instructional technology. Recent socio-cultural approaches to learning and knowing, called "Thinking Practices," provide such an alternative. Goldman & Greeno (1998) argue that the concept of Thinking

Practices "is symbolic of a combination of theoretical perspectives of how people learn, how they organize their thinking inside and across disciplines" (p.1). This perspective, focusing on socio-cultural learning rather than the development of individual capabilities, views instruction within a complex social system, with learning being distributed within the community. This Thinking Practices framework can be considered in terms of what Flechsig (1997) has termed a 'higher order design'; an instructional design which is based on a cultural perspective of learning and includes educational values, educational knowledge, social relations, and the organization of learning time and learning space. A higher order design reflects the human experience in learning contexts and, in turn, provides an abstract model of instruction.

In this paper we use Thinking Practices as an abstract higher order design concept. In this way, there are many different possible lower order designs that can result in specific and unique learning experiences within the Thinking Practices framework.

The Thinking Practices framework is well-grounded in research (Greeno et al., 1996) but, as will be apparent in the following paragraphs, this research does not necessarily take the form of the positivist, empirical studies well-known by educational psychologists. Instead, the studies typified in Thinking Practices research are more aptly described as "design experiments" (Brown, 1992). In design experiments, researchers attempt to 'engineer' the complex system of a classroom environment by introducing new and innovative practices, while recognizing that learners and instructors are equal partners in the process. The researchers then evaluate the environment they created to assess the effectiveness of these practices using both quantitative and interpretive methodologies. Because design experiments look at the classroom as a complex system, they focus on learning as being distributed across the classroom (or training) community.

The following description of the core constructs in the Thinking Practices framework have been derived from Lave & Wenger's seminal works on situated learning (Lave & Wenger, 1991; Wenger, 1998). Based on their own as well as others' ethnographic research, Lave & Wenger attempted to present a comprehensive theory on how people learn in real working environments. This perspective has provided a new way of analyzing learning, and is much different from what has been traditionally employed in classroom-based research (Greeno & Goldman, 1998). Viewing the Thinking Practices framework as an example of a Community of Practice one can identify a set of core constructs, including a) trajectories of participation, b) activity and participation structures, c) identities, and d) artifacts and tools. In the following section we describe these core ideas and constructs.

Communities of Practice (CoP)

Lave and Wenger (1991) introduced the term Community of Practice as: "a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice" (p. 98). In describing their view of 'situated thinking', Goldman & Greeno (1998) state: "We prefer an image that represents a group of people in an animated conversation interacting with materials that they are reasoning about and with which they are developing representations of their ideas" (p. 2). There is a striking similarity between the core ideas presented in Goldman & Greeno's definition and in Lave & Wenger's as they both focus on the 'practice' aspect of situated learning. Wenger (1998) posits that the idea of practice connotes not only doing, but doing in a historical and social context. Thus, Thinking Practices represent a possible instantiation of a Community of Practice.

Wenger (1998) identifies three essential characteristics within a Community of Practice: mutual engagement, shared repertoire, and joint enterprise. Mutual engagement refers to a shared enterprise or goal that participants of a community are engaged in. Shared repertoire refers to the common resources (including discourse, hardware (product), and processes) that have been created in the community over time. Joint enterprise refers loosely to a common negotiated goal in which participants engage. These characteristics are evident in the following examples of different educational examples of thinking practice.

Saxe & Guberman (1998) showed how a game designed to teach mathematical reasoning created a community of learners through the roles the learners assumed during the game. These learners were engaged in 'distributed problem solving' as they often came to the aid of each other in order to keep the game flowing. Wenger's (1998) characteristics are easily identified as learners are mutually engaged in the game which has its shared repertoire of game pieces, rules, as well as the processes it is eliciting. In addition, there is joint enterprise as the students would not only try to win the game but would also come to the aid of their 'opponent' to keep the game moving.

Brown, Ellery & Campione (1998) and Riel (1998) were able to develop computer mediated thinking practices through the use of e-mail, joining learners from different parts of the country. A class could pose a problem or situation to other groups or individuals and then get feedback, ideas, and discussion from the others to help them solve their problem. Thus the different groups would be involved in the joint enterprise of arriving at a solution to one of the problems. Through mutual negotiation, different participants (or groups of participants) were able to provide unique views based on their geographical location and unique experiences, showing that multiple perspectives to

problem solving were possible. The students in this activity developed a shared repertoire of concepts, issues, and problem solving approaches.

These examples demonstrate that a Thinking Practices approach assumes that knowledge does not reside inside the mind of a single person. Knowledge is instead distributed across people, tools, and different communities of practice. This distributed nature of knowledge arguably facilitates 'deeper' thinking. diSessa & Minstrell (1998) showed in their benchmark lessons that conceptual change can be fostered in a physics lesson as learners collaboratively work through and discuss a physics problem. Learners are given a real life problem and then *they* go about solving it (as opposed to the teacher showing them how to solve it). Through mutual engagement and joint enterprise, the learners not only learn the content but also understand physics as a method of thinking. The shared repertoire in this example is not only the physics 'concepts' but also the physicists' 'processes'.

These examples demonstrate Flechsig's (1997) notion of a 'lower order designs': specific instructional interventions based on the higher order design that the Thinking Practice approach provides. The focus in these examples on the process of inquiry and understanding is a fundamental characteristic of Thinking Practices as it fosters the growth of deep collective knowledge, much deeper than what might occur on an individual basis. These are facilitated through the characteristics of mutual engagement, joint enterprise, and shared repertoire. In the following sections, we examine the core constructs of a Thinking Practices approach.

Trajectories of Participation

The term *trajectory* refers "not [to] a path that can be foreseen or charted but a continuous motion, one that has momentum of its own in addition to a field of influences" (Wenger, 1998, p. 154). Wenger's definition suggests that trajectories stem from a person's desire to be part of the community and the community's intrinsic affordances. Trajectories are inherently tied to one's identity, which is redefined over time as one assumes new roles and levels of participation in a community of practice.

Stein, Silver & Smith (1998) described a case in which new teachers' trajectories were initially peripheral while progressing toward a more central role. These teachers were learning what was "valued and practiced by their immediate circle of colleagues" (Stein, Silver & Smith, 1998, p. 30). As teachers participated in workshops, discussions, meetings and courses they were able to

gain the knowledge and skills through their interactions with more 'experienced' teachers. This trajectory allowed the teachers to participate more fully in their community of practice.

The trajectory described above is an example of an "inbound" trajectory (Wenger, 1998) in which participants move towards fuller participation in a community. Although this may be the preferred type of trajectory from a traditional school-based learning perspective, Wenger (1998) identified other types of trajectories that are equally important:

- **Inbound**: community members are engaged in activities that lead to fuller participation within the community.
- **Peripheral**: community members are engaged in activities in which they remain peripheral to the community.
- **Insider**: established members engage in activities in which they adapt to new internal demands or external conditions.
- **Boundary**: community members engaged in activities that lie between two different communities, often joining the communities.
- **Outbound**: community members engaged in activities that lead out of the community.

These differences indicate that trajectories are not always linear paths to full participation in a community, for some may choose to maintain peripheral or boundary roles while others may pursue more central roles. Although the inbound trajectory has been traditionally viewed as the most valid, Wenger (1998) argues that learning and the sharing of knowledge often occurs in the intersection between communities. Thus someone who is able to successfully engage in a boundary trajectory (e.g., act as a "broker") between two communities could distribute 'knowledge' and its reinterpretation between the communities.

Activity and Participation Structures

In a Thinking Practices approach, learners are regarded as sense making individuals who bring to a task considerable intuitive knowledge that they may use to solve problems (diSessa & Minstrell, 1998). Through mutual engagement learners are encouraged to use their own intuitions and experience as they engage in collaborative research and exploration, and refine knowledge through hypothesis testing and dialogue with other community members.

A Thinking Practices environment is also dynamic. Through joint enterprise learners are able to maintain various and different trajectories. As learners participate in problem solving

activities, their own understanding of the problem and the processes used to solve it emerge (Saxe & Guberman, 1998). Because these processes are carried out in a constantly changing environment, learners experience the same successes and frustrations of real mathematicians, scientists, and historians. In short, members learn how to learn by adopting the thinking practices of the community.

Identities: Power and Roles

There is a marked transfer of power in a Thinking Practices environment. Through joint enterprise learners assume the responsibility for their own learning and the learning of others; the traditional role of the teacher or instructor is instead changed to that of coach, mentor, and/or facilitator. Thus, learners may take on reciprocal instructional roles as they engage each other in a critical discourse surrounding problem solving. This discourse serves to move students from legitimate peripheral participation to more central participation, as they become more familiar with problem solving practices and other activity structures.

This distribution of power encourages learners to focus on the underlying processes of solving problems rather than outcomes. Moreover, because the problem solving ability resides in the collective knowledge and abilities of the group, no one student is required to take on complete responsibility. Learners may assume differing trajectories at different times, depending on their needs and interests. But as long as they maintain a sense of ownership of the process, they could be considered legitimate participants.

Artifacts and Tools

Within a complex Thinking Practices environment, the learner is given opportunities to discover the artifacts and tools within the environment and learn how to effectively use them. These artifacts and tools comprise much of the shared repertoire that is necessary for learners to become full participants. In some environments, these artifacts and tools help define the learner's identity within the community. Artifacts may have a somewhat abstract nature, such as that found in any oral or written language artifacts. These support varying degrees of affordance to the learners in their problem solving process. In addition, they serve to regulate emergent goals (Saxe & Guberman, 1998). Tools also have inherent affordances that support the learner's ability to effectively approach, manipulate, represent, and solve a problem (e.g., a calculator). Through engagement with the artifacts and tools learners establish themselves within the shared history and culture of the community of practice.

Summary of Thinking Practices perspective

The defining characteristic of Thinking Practices is an environment that not only permits learners to assume the identity of the mathematician, historian, or sociologist as they work through a problem but also encourages them to do so. This identity is much different from the one that emerges when learners are passively fed information. By placing the learner in a social milieu with its accompanying artifacts, he/she is allowed negotiate the meaning of information and construct new knowledge. By doing so, learners are better able to "create new images of the world and of themselves" (Wenger, 1998, p. 176). It is this identity and particular view of one's place in the world that embodies the Thinking Practices approach and thus sets it apart from other learning approaches.

Throughout this discussion on Thinking Practices, important implications about learning have been made. These are summarized as follows:

- Cognition is linked to social and cultural practices, tools, power and role relations.
- Knowledge is culturally mediated and socially shared. Knowledge is distributed across people, tools, and Communities of Practice.
- Activity structures focus on the growth of deep, collective knowledge (as opposed to individual knowledge).
- Learning is viewed as sense-making, with an emphasis on social discourse in the learning process. Learning is the result of various trajectories of participation and identities within a community of practice.

A Thinking Practices Analysis of Instructional Technology

Using the key aspects of the Thinking Practices approach, we have created a framework for analyzing the communities of practice associated with instructional technology and design. This framework consists of the four previously defined elements: a) practices and activity structures, b) identities, c) trajectories of participation, and d) artifacts and tools. In addition, we use Collins' (1998) distinction of two types of communities[1] along a continuum: a) conserving and b) learning.

Simply stated, the primary goal of a community identifies where it falls along the continuum. In a conserving community, the primary goal is to preserve and propagate a stable

knowledge base. In contrast, a learning community's primary goal is to increase its collective knowledge. Of course, the preservation and creation of knowledge actually takes place in both types of communities. Thus, any community will have both "conserving" and "learning" characteristics; an entire spectrum of possible goals and activities may exist within a community of practice, but certain characteristics will dominate. Nonetheless, to help illustrate this framework in a simple manner, we will compare the two types of communities at the extreme ends of this spectrum. Combining the key aspects of Thinking Practices and the two types of communities results in the framework shown in Table 1.

Practices and Activity Structures

In a conserving community of practice, the thinking practices and activity structures of instructional systems design would be oriented toward facilitating the transmission of information and the acquisition of a standardized knowledge base. In such a community, members would seek to comply with the expectations of fact and skill acquisition.

Table 1. Dimensions of the Thinking Practices framework.

	Practice and Activities	Identities	Trajectories	Artifacts and Tools
Conserving Community ⇕ **Learning Community**				

At the other extreme, a learning community of practice would employ thinking practices and activity structures that orient learners towards more central participation within the community. Activities would include collaboration between members, active research and experimentation, and contributing to the collective knowledge bases. Use of information technology within this community would focus on improving communication between its members and providing open

[1] At this point we must refer to the more generic term 'community' as Collins (1998) did not refer specifically to a Community of Practice.

access to all resources. In this way, the process would more closely resemble design experiments (Brown, 1992).

Identities and Trajectories

The identities and trajectories of members within a conserving community are more narrowly defined. Learning and training is directed by a centralized authority and focused on standardized knowledge and targeted at individual learners. Participation within the community is prescribed, providing less room for negotiation by its members. Instead, members must stay within the historical boundaries of the community. Finally, learners are not usually recognized and fully participating members within the community.

Within a learning community, trajectories and identities can emerge more dynamically. For example, authority roles can be emergent. Learning and training efforts center on building and sharing collective knowledge among all members, including learners. Indeed, learners may be on equal footing with other members of the community.

The construct of trajectories within a community of practice provides clarifying implications. Most instructional activities would seem to be targeted at users with inbound trajectories, with the goal of moving a community member to full, central participation. However, the framework suggests that other members of the community of practice--those with insider, outbound, peripheral and boundary trajectories--may also contribute in novel ways.

Artifacts and Tools

Perkins (1992) provides a useful classification for viewing the use of tools and artifacts within a community of practice. In particular, he identifies five "facets" of learning environments, which can be used to categorize artifacts and tools: a) information banks, b) symbol pads, c) construction kits, d) phenomenaria, and e) task managers.

Information banks are simply sources of information. Although people can be included within this category, information banks are typically comprised of organized databases, such as encyclopedias, dictionaries, textbooks, manuals, etc.

Symbol pads consist of tools or surfaces that allow for the construction and manipulation of symbol systems. These include computer programs, such as word processing programs, spreadsheets, databases, and drawing programs. However, the traditional classroom tools of chalkboards, calculators, paper tablets and pencils also qualify.

Construction kits are made up of a "fund of prefabricated parts and processes with emphasis falling on molar things and actions" (p. 47). The many forms of laboratory apparatus are examples of construction kits that have been used in the past. In addition, toy construction sets can be employed to build an almost limitless number of models. However, this category applies not just to concrete objects. Abstract models can also be constructed with computer programming languages.

Closely related to construction kits, phenomenaria are spaces in which things can be manipulated and examined. Terrariums, aquariums, zoos, museums, and computer-generated models are all examples of areas that provide the learner with opportunities to explore complex models, systems, or environments.

Finally, task managers are the "elements of an environment that set tasks to be undertaken in the course of learning, guide and sometimes help with the execution of those tasks, and provide feedback regarding process and/or product" (p. 48). Although stand-alone computer-based instruction programs and intelligent tutors have gained some popularity in the past two decades, many task manager functions are still best carried out by people, including instructors and the learners themselves.

While these categories are not mutually exclusive--there is some overlap with some tools like spreadsheets--they can be helpful in analyzing how communities of practice use artifacts and tools to reach their primary goals. Furthermore, they give us insight into the different trajectories within those communities.

In a conserving community, one would expect to find a plethora of information banks, as these would be the primary preservation tool for the knowledge base. Symbol pads would be designed to promote the standardized symbol systems of the community. Construction kits and phenomenaria would be used to create and preserve realistic samples of models, systems, or environments important to the community. The role of task managers would be to ensure that the members of the community internalize and use the contents of the information banks in an effective and efficient way.

In a learning community, information banks may still used quite heavily, but there is an emphasis on adding to the community's collective knowledge. Symbol pads are designed to be flexible tools, allowing members to create, visualize, and use new, nonstandard symbol systems. Construction kits allow people to create new designs and models--whatever their imaginations

conceive. In addition, phenomenaria can be used to create systems and environments in which these new models are examined and tested. Finally, task managers in a learning community promote the exploration, reflection, and articulation of new experiences.

Thinking Practices Exploratory Case Study

The Thinking Practices framework is substantially different from the more traditional instructional approaches exemplified in the ADDIE model. We believe that it is also a more useful approach for designing instruction for organizations in the Information Age. However, the Thinking Practices framework is still mainly based in theory and has not been used extensively in practice. Thus, it is necessary to test the framework to see if it is a viable tool for analyzing and solving the types of problems encountered by instructional technologists. While an exhaustive study is beyond the scope of this paper, we have begun to use the framework to examine instructional problems within a local community of practice: the Instructional Technology department at Utah State University.

In particular, in order to test the usefulness of the Thinking Practices framework, an exploratory case study was conducted to examine the roles, identities, and trajectories of graduate students in the USU instructional technology program. The general question under investigation was how participants in the study perceive their past, present, and future roles within the field of instructional technology as they participated in various communities of practice. While this question does not address all aspects of the framework in detail, it provides useful information in two ways. First, it acts as a general, qualitative question from which more specific research questions can arise. Second, it allows us to examine the framework as it applies to a community of practice within the field of instructional technology. Specifically, can the framework by used productively by participants in order to reflectively analyze the practices on instructional technology.

Methodology

The first data collection strategy consisted of a large group brainstorming activity, in which participants wrote on large sheets of paper with multicolored crayons. The brainstorming activity followed a presentation on the Thinking Practices framework given to students and faculty of the instructional technology department. During the activity, 19 participants were asked to identify the instructional technology communities of practice in which they participate. They were then instructed to list the various roles they fulfill within these communities. Lastly, participants listed the various trajectories associated with one or more of these roles. In many ways, this brainstorming

activity acted like a free-form survey that developed as the participants drew on the paper and organized their roles and identities around specific communities of practice. These brainstorming sheets were collected after the presentation and analyzed using the Thinking Practices framework.

The second data collection procedure involved personal interviews with two graduate students. This allowed for a deeper examination of student perspectives. These interviewees were chosen because they worked with one of the investigators and had an established relationship. It was assumed that because of this relationship 1) the interviewees would be able to more easily share information about communities of practices in both school and work settings and 2) the investigator would more easily understand the context for their responses. The Thinking Practices framework was used to develop the questions and guide the interview, and both interviews had similar formats.

Population Selection and Participants

The graduate students involved in the brainstorming activity consisted of only those who attended the presentation. No systematic sampling procedure was used, as this was a preliminary activity for the interviews and observations. The members of this group were a mixture of male and female graduate students with approximate ages between 22 and 60 years. The amount of time spent in the graduate program ranged from 3 months to over 24 months. A total of 22 sheets were collected, but three were excluded from analysis due to either student errors in completing the activity or difficulties in interpreting what the students had written. Thus, a total of 19 sheets were analyzed.

Data Collection

Data for the brainstorming activity were collected and analyzed by two investigators. The Thinking Practices framework was used to identify the types of communities and the trajectories of participation. Interview data was collected using a tape recorder, and notes were taken during the interview. In addition, a sheet containing the Thinking Practices framework and the five types of trajectories was used as a prompt for both the interviewees and the interviewer.

Data Analysis and Interpretation

Analysis of the brainstorming data revealed that the participants felt connected to four major categories of communities of practice: a) university groups, b) jobs or corporation work groups, c) online communities, and d) research groups (see Table 2).

Table 2: Results of brainstorming data from 19 subjects

	Total No.	Mean per subject	Most Common	% of Total
Communities of Practice	121	6.37		100%
Universities	60	3.16	*	50%
Corporation	15	0.79	*	12%
Other	14	0.74		12%
Research Group	13	0.68	*	11%
Online	10	0.53	*	8%
Family	5	0.26		4%
Service Org.	2	0.11		2%
Institute	1	0.05		1%
Grant	1	0.05		1%
Trajectories	154	8.11		100%
Inbound	53	2.79	*	34%
Insider	52	2.74	*	34%
Peripheral	24	1.26		16%
Boundary	16	0.84		10%

Outbound	9	0.47		6%

Participants also felt connected to service organizations, family groups, and various other groups which didn't seem to fit into any specific category or pattern. It should be noted that these are categories created by the *investigators*, not by the participants. For example, participants did not list "university" as a community of practice, but rather listed various groups they were part of that seemed to them to fit the definition of a community of practice. The investigators used several a priori categories, such as "university" and "research group," and other categories developed during the data analysis. Furthermore, there was no attempt to ensure that the groups identified by the participants fit any strict definition of "communities of practice." The brainstorming activity was envisioned as an exploration of the Thinking Practices concepts, not as a test to determine how well the participants had understood the presentation. Thus, we do not interpret the findings presented in Table 2 as reliable, valid support of any particular Thinking Practices concept. Rather, the table is interpreted as simply interesting data meant to spur further thought about the usefulness of the Thinking Practices framework.

Considering the characteristics of the sample group, these findings are not surprising. After all, the instructional technology program is completed in a university setting where professors and Ph.D. students are involved in research projects. In addition, a large part of the program focuses on creating instruction for industry and business. Furthermore, in the last three years, greater emphasis has been made on the role of technology in delivering web-based instruction, which helps explain the high number of "online" communities of practice.

The data indicated that participants engage in roles that are primarily related to insider or inbound trajectories of participation. One interpretation of this data is that the large percentage of inbound (34%) and insider (34%) trajectories reflects two separate student perceptions. First, the inbound participants believe that they are so new to the field that they cannot contribute much to the activities of the various communities of practice. These participants often feel caught up in the "conserving" activities of the community. They are not confident enough with their level of skill and knowledge to engage in the "learning" activities of the group. Second, the insider participants feel like established members of these communities. They are confident in their abilities to contribute to the "learning" activities of these groups. This interpretation of the data would lead us to believe that

the inbound participants view the department as a "conserving" community of practice, while the insider participants see the department as a "learning" community.

While this interpretation of the brainstorming data seems logical, it is challenged by the interview data. One interviewee, which we will call Kim, was new to the field and identified herself as an inbound member of the instructional technology department. The interview was given during her first semester in the program. The other interviewee, who we will refer to as Pat, was in her second semester of class work and considered herself to be an established member of the department on an insider trajectory. Both also thought that their roles as learners were dynamic. Kim noted her role would change from day to day, depending on such things as the kinds of activities in which the group was engaged, the makeup of the student groups, or even personal mood. During the interview, the investigator drew a circle and asked Kim to indicate her role in relation to the department by showing where she would place herself in that circle. She stated the following about her role and trajectory of participation:

> "It really depends upon the material and my background with the material. And how…if I have no background with something. Let's say we'll talk about Cold Fusion one day. If I don't have any background and it's not made relevant to me in any way, I'm hitting on the outside of the circle. I'm not getting it. Generally, I think I'm about half way with most of the stuff that we talk about. Because I've been in the program long enough to have a basic understanding of what is going on. With the theory, the general concept of tools, with everything. So I do have some understanding of pretty much everything. Very few things bring me into the center though, so far. I don't know if that's necessarily because I'm not moving into the center, or because…I don't know if I'm just not latching on yet. I think maybe what I need to understand is keeping out here. And then I as I continue the classes I take will bring me into the center so I'll really get a grasp, a focus. Find my niche, I guess."

Based on the data gathered in the brainstorming activity and the interviewees self-assigned trajectories, one might think that Kim would see the department as a conserving community and Pat as a learning community. After all, Pat has had more time to become grounded in the literature of the field. It is of interest, however, to note that Kim actually thought the department was mainly a "learning community." When asked what type of community the department was, she stated:

> "I would say about 80% learning and 20% conserving. 'Cause there are certain things that need to exist, that need to remain, but overall it's very open. I mean they're into modern

> thought, modern developments. Discussions in class are not limited to topics that can be brought up or ideas that can be explored. It's very elastic. Very elastic."

Pat, on the other hand, perceived the department to be a "conserving community" at the exact opposite ratio of Kim's perception: 20% learning and 80% conserving. This contrast between the two interviewees is all the more surprising when one considers that they take many of the same classes and have similar work responsibilities. Clearly, we cannot assume that those on an inbound trajectory will necessarily perceive the community to be involved mainly in "conserving" activities. Likewise, an insider who is in the best position to participate in "learning" activities may still perceive himself/herself to be part of a "conserving" community.

Despite the fact they differed on this key point, Kim and Pat did share number of perceptions about the department and/or instructional program. They both focused on their relationships with teachers and students. Indeed, they seemed to base their perceptions of their roles and trajectories on interpersonal relationships, rather than content, problems, or activities. The most important relationship discussed by both women was that between the student and teacher. Both felt that the teacher-student interaction was an extremely important element of the program--one that helped determine their roles and trajectories. Pat described the teachers as being "helpful, friendly," and open to feedback from the students. Kim mirrored this observation when she mentioned the relationships between students and faculty in the department:

> "One of the things that impresses me the most is coming from an undergraduate environment to this is that there is so much more involvement from the student side. That the faculty actually listen to what you have to say and they take it into consideration, rather than "Oh, that's nice, but we know better than you." And we can have as much voice as we desire to have with the faculty and with even right now we're discussing what courses should be offered in the summer. That would have never happened anywhere else."

Discussion

This preliminary study has supplied a number of interesting points related to the initial research question. On a personal level, participants seem to experience dynamic roles and trajectories of participation. The movement between these roles is partially based on the teacher-student relationship at that moment in time. As a whole group, the members of this department see themselves mainly moving on both inbound and insider trajectories. Furthermore, they see

themselves as participants in both "learning" and "conserving" activities within this community of practice.

This study also indicates that the Thinking Practices framework is useful for examining a community of practice in the field of instructional technology. The results show that identities and trajectories are useful constructs for analyzing and interpreting the roles of members in a community of practice. Future research will expand upon this study by examining this same question as applied to the faculty and staff in the department. It is also hoped that future research will lead towards a methodology that allows for the identification and classification of different activities and practices, as well as the function of artifacts and tools.

Conclusion

Our analysis of Thinking Practices has led to the development of a framework with which we have examined the practices of instructional technology within the larger enterprises of training and education. The results of our analysis are summarized in Table 3.

Table 3. Application of the framework

	Practice and activities	**Identities**	**Trajectories**	**Role of artifacts and tools**
Conserving community	Design for transmission of knowledge. Design for acquisition of facts and skills. ADDIE design methodology.	Design focus on individual learning. Centralized authority. Learners are not viewed as fully participating members of community.	Less negotiation of trajectories.	Information banks emphasized. Symbol pads promote standardized symbol system. Construction kits and phenomenaria replicate important knowledge of the community. Task Managers focus on internalization of information banks. Task managers replicate hierarchical structure.

Learning community	Design for participation in a community of practice. Design as research and experimentation. Design for collaboration and communication. Use of design experiments.	Design focus on collective knowledge. Emergent authority. Dynamic identities. Focus on building and sharing collective knowledge. Learners are fully participating members of community.	Trajectories are dynamic. Learning as a focus on inbound trajectories. Other trajectories can contribute to design process in novel ways.	Information banks continually growing. Symbol pads use to create new symbol systems. Construction kits support new representations. Phenomenaria as laboratories. Task Managers promote discourse, articulation, and reflection.

As instructional technologists actively engaged in the field, we believe that our analysis offers important implications for the field. First, recall that learning and conserving communities are viewed along a spectrum and that organizations will engage in both types of activities. As defined by Collins (1998), these labels are not intended to ascribe value. Nevertheless, we believe that the theories and practices of instructional technology that support "learning" communities will result in products and processes that are more adaptive in the current rapidly changing technological environment. By this, we mean that an organization that adopts a learning community perspective can better adopt and integrate emerging technologies. Furthermore, instructional technologists that operate within the constraints of the Thinking Practices framework will be more likely to meet the training and educational needs of these kinds of organizations.

The Thinking Practices framework also highlights the wide diversity that exists within and around the field. While this conclusion is hardly novel, we believe that the framework offers a different perspective on this diversity. In particular, it offers a means for categorizing and clarifying this diversity. For example, as the field of instructional technology seeks to develop common threads that bind professionals, various communities within the field will find their members on different trajectories as they share, collaborate, and develop theories, tools and products. By establishing boundary trajectories as members of different communities, instructional technologists may find renewed identity by fostering an attitude of cooperation and collaboration between and within the many communities of practice that comprise the field.

As previously described, the framework suggests alternate approaches for conceptualizing instructional design methodologies and the instructional systems design (ISD) process. For example, instead of relying of the sequential and iterative ADDIE approach, design can be viewed as involving different communities of practice, and employing different artifacts and tools. Moreover, participants within various communities may have a wide range of identities and trajectories of participation in the design process, resulting in roles that go well beyond that of subject matter expert. Our framework also highlights a number of questions related to the target environment that should be considered during the design process. For example, is the target learner group part of a conserving or learning community? What are the roles, trajectories and identities of the target learners? What are the target activity structures? Are there particular Thinking Practices that should be considered? What is the relation of the instructional technology to the artifacts and tools commonly used in the target community of practice?

Instead of using the ADDIE model to create static instructional events that focus on the delivery of the content of the knowledge base, the instructional design process within a learning community involves identifying core activity structures and thinking practices in target communities of practice. Instructional design itself is viewed as an active process of research, experimentation, and reciprocal discourse involving all members.

Acknowledgements

Portions of this paper were presented at the 1999 Instructional Technology Summer Institute, September, Logan, Utah, and the 2000 Annual meeting the American Educational Research Association (AERA), April, New Orleans.

References

Brown, A. (1992). Design Experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning Sciences, 2(2),* pp. 141-178.

Brown, A., Ellery, S. & Campione, J. (1998). Creating zones of proximal development electronically. In J. Greeno and S. Goldman (Eds.), *Thinking practices in mathematics and science learning* (pp. 341-368). New Jersey: Lawrence Erlbaum.

Collins, A. (1998). Learning communities: A commentary on chapters by Brown, Ellery, and Campione, and by Riel. In J. Greeno and S. Goldman (Eds.). *Thinking practices in mathematics and science learning* (pp. 399-405). New Jersey: Lawrence Erlbaum.

Derry, S., & Lesgold, A. (1996). Toward a situated social practice model for instructional design. In D.C. Berliner, & R.C. Calfe (Eds.). *Handbook of Educational Psychology* (pp. 787- 806). New York: Simon &b Schuster McMillian.

diSessa, A & Minstrell, J. (1998). Cultivating conceptual change with benchmark lessons. In J. Greeno and S. Goldman (Eds.). *Thinking practices in mathematics and science learning* (pp. 155-188). New Jersey: Lawrence Erlbaum.

Flechsig, K. (1997). Cultural transmission, teaching, and organized learning as culture-embedded activities. . In R.D. Tennyson, F. Schott, N.M. Seel, & Dijkstra, S (Eds.). Instructional design: International perspectives Volume 1: Theory, Research, and models. pp.25-39. New Jersey: Lawrence Erlbaum Associates.

Goldman, S. and Greeno, J. (1998). Thinking practices: Images of thinking and learning in education. In J. Greeno and S. Goldman (Eds.). *Thinking practices in mathematics and science learning* (pp. 1-52). New Jersey: Lawrence Erlbaum.

Gordon, J. and Zemke, R. (2000). *Training*. April, pp. 43-53.

Greeno, J. and Goldman, S. (Eds.) (1998). *Thinking practices in mathematics and science learning*. New Jersey: Lawrence Erlbaum.

Greeno, J., Collins, A., and Resnick, L. (1996). Cognition and Learning. In D. Berliner and R. Calfee (Eds.) *Handbook of Educational Psychology* (pp. 15-46). New York: Simon and Schuster.

Greenwood, T., Wasson, A., & Giles, R. (1993). The learning organization: Concepts, processes, and questions. *Performance and Instruction, 32* (4), pp. 7-11.

Kiser, K. (1999). Hot Jobs, *Training*, August, pp. 29-35.

Lampert, M. (1998). Studying teaching as a thinking practice. In J. Greeno and S. Goldman (Eds.). *Thinking practices in mathematics and science learning* (pp.53-78). New Jersey: Lawrence Erlbaum.

Lave, J. and Wenger, E. (1991). *Situated learning: Legitimate Peripheral Participation.* Cambridge, England: Cambridge University Press.

Lawrence, S. and Giles, C. (1999). Accessibility of Information on the Web, *Nature*, Vol. 400, pp. 107-109.

Orey, M.A., & Nelson, W.A. (1997). The impact of situated cognition: Instructional design paradigms in transition. In C.R. Dills & A.J. Rominszowski (Eds.). *Instructional Development Paradigms* (pp. 283-296). Englewood Cliffs, New Jersey: Educational Technology Publications.

Perkins, D. N. (1992). Technology meets constructivism: Do they make a marriage? In T. Duffy and D. Jonassen (Eds.) *Constructivism and the technology of instruction: A conversation.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Reigeluth, C.M. (1996). A new paradigm for ISD? *Educational Technology, May-June*, pp.13-20.

Resnick, L. (1987, December). Learning in school and out. *Educational Researcher*, 13-20.

Riel, M. (1998). Learning communities through computer networking. In J. Greeno and S. Goldman (Eds.). *Thinking practices in mathematics and science learning* (pp. 369-398). New Jersey: Lawrence Erlbaum.

Saxe, G. and Guberman, S. (1998). Emergent arithmetical environments in the context of distributed problem solving: Analyses of children playing an educational game. In J. Greeno and S. Goldman (Eds.). *Thinking practices in mathematics and science learning* (pp. 237-256). New Jersey: Lawrence Erlbaum.

Seels, B. and Richey, R. (1994). *Instructional technology : The definition and domains of the field.* Washington, D.C.: Association for Educational Communications and Technology.

Senge, P.M. (1990). *The fifth discipline: The art & practice of the learning organization.* London: Random House.

Stein, M., Silver, E., and Smith, M. (1998). Mathematics reform and teacher development: a community of practice perspective. In J. Greeno and S. Goldman (Eds.). *Thinking practices in mathematics and science learning* (pp. 17-52). New Jersey: Lawrence Erlbaum.

Wenger, E. (1998). *Communities of practice: Learning, Meaning, and Identity.* Cambridge: Cambridge University Press.

Zinberg, D. (1998). Cybertech battle for campuses, *The Times Higher Education Supplement*, (20 February), p. 18.